Product Specifications

20.1" VGA Color TFT-LCD Module
Model Name: T201VN01 V1

( ) Preliminary Specifications
(◆) Final Specifications

Note: This Specification is subject to change without notice.

Contents

Record of Revision

Version	Date	Chapter	Description	Remark
0.0	Jan. 07,'04		First Draft (Preliminary)	
0.1	Jan. 08,'04	3-3	Clock Freq. Min & Max	Add
		4	Luminance Variation	Add
			R,G,B, Coordinate	Add
0.2	Feb. 17,'04	3-1	Add power supply input current & Irush current	
		3-3,3-4	Modify Timing table and add timing waveform	
		3-5	Add color input data reference table	
		3-6	Integral Power sequence chart	
		4	Modify Luminance from 1.6 to 1.3 (max)	
		8	Add packing detail	
0.3	Feb. 27,'04	4	Add Contrast Ratio spec 450(min)	
0.4	Mar. 02,'04	Page 8	Change CCFL min Frequency (from 52KHz to 50kHz)	
		Page 8	Change CCFL max Frequency (from 58KHz to 60kHz)	
0.5	Mar. 23,'04	4	Change Gray to Gray Average response time spec to 16ms (max)	
0.6	Mar. 31,'04	3-2	Add a note in LVDS order	
		3-4	Add a note	
		3-6	Modify Power Sequence	
1	Apr. 27,'04	3-6	Power Sequence modification	

1. General Description

This specification applies to the 20.1 inch Color TFT-LCD Module T201VN01. This LCD module has a TFT active matrix type liquid crystal panel 640x480 pixels, and diagonal size of 20.1 inch. This module supports 640x480 VGA mode (Non-interlace). This module is without inverter.

Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes. Gray scale or the brightness of the sub-pixel color is determined with a 8-bit gray scale signal for each dot.

The T201VN01 has been designed to apply the 8-bit 1 channel LVDS interface method. It is intended to support displays where high brightness, wide viewing angle, high color saturation, and high color depth are very important.

* General Information

| Items	Specification	Unit	Note
Active Screen Size	20.1 inches		
Display Area	408 (H) x 306(V)	mm	
Outline Dimension	434.0(H) x 331.2(V) x 30.6max (D)	mm	Without inverter
Driver Element	a-Si TFT active matrix		
Display Colors	16.7M	Colors	
Number of Pixels	640 x 480	Pixel	
Pixel Arrangement	RGB vertical stripe		
Display Mode	0.6375(H) x 0.6375(W)		
Surface Treatment	Hard-Coating 3H, AG		

2. Absolute Maximum Ratings

The following are maximum values which, if exceeded, may cause faulty operation or damage to the unit.

Parameter	Symbol	Min.	Max.	Unit	Note
Power Input Voltage	Vcc	-0.3	5.5	V_{dc}	At 25±5℃
Operating Temperature	T_{OP}	00	50	℃	1
Storage Temperature	H_{ST}	-20	60	℃	1
Operating Ambient Humidity	H_{OP}	10	90	%RH	1
Storage Humidity	H_{ST}	10	90	%RH	1

Note: 1. Temperature and relative humidity range are shown in the figure below. Wet bulb temperature should be 39℃
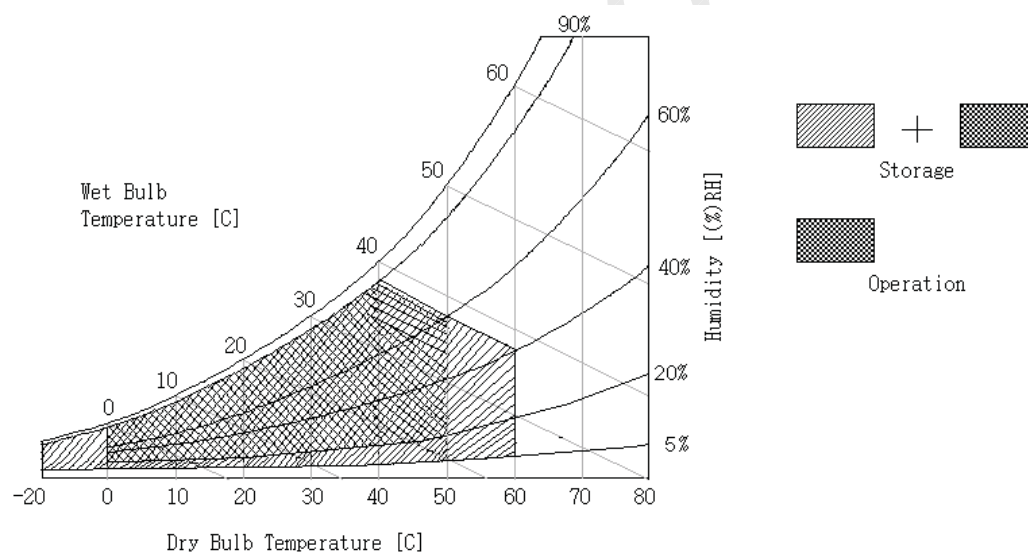
3. Electrical Specification

3-1 Electrical Characteristics

The T201VN01 requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The second input which powers the CCFL, is typically generated by an inverter.

Parameter	Symbol	Values			Unit	Notes
		Min	Typ	Max		
LCD:						
Power Supply Input Voltage	Vcc	4.5	5.0	5.5	Vdc	
Power Supply Input Current	Icc	-	600	700	mA	1
Power Consumption	Pc	-	3.0.	-	Watt	1
Inrush Current	I_{RUSH}	-	-	5.7	Apeak	1
Lamp Power Consumption			41.04		W	2
Life Time			50,000			3

The design of the inverter must have specifications for the lamp in LCD Assembly. The performance of the Lamp in LCM, for example life time or brightness, is extremely influenced by the characteristics of the DC-AC Inverter. So all the parameters of an inverter should be carefully designed so as not to produce too much leakage current from high-voltage output of the inverter. When you design or order the inverter, please make sure unwanted lighting caused by the mismatch of the lamp and the inverter (no lighting, flicker, etc) never occurs. When you confirm it, the LCD Assembly should be operated in the same condition as installed in your instrument.

Do not attach a conducting tape to lamp connecting wire. If the lamp wire attach to conducting tape, TFT-LCD Module have a low luminance and the inverter has abnormal action because leakage current occurs between lamp wire and conducting tape.

The relative humidity must not exceed 80% non-condensing at temperatures of 40℃ or less. At temperatures greater than 40℃, the wet bulb temperature must not exceed 39℃. When operate at low temperatures, the brightness of CCFL will drop and the life time of CCFL will be reduced.

Note1：The specified current and power consumption are under the Vcc=5.0V, 25℃, fv= 60Hz, fCLK=25.2Mhz condition whereas mosaic pattern (8x6) is displayed and fv is the frame frequency.

Note2：The lamp power consumption shown above does include loss of external inverter at 25 ℃. The used lamp current is the lamp typical current

Note3：The life is determined as the time at which luminance of the lamp is 50% compared to that of initial value at the typical lamp current on condition of continuous operating at 25 ±2℃

The output of the inverter must have symmetrical (negative and positive) voltage waveform and symmetrical current waveform (Asymmetry ratio is less than 10%). Please do not use the inverter which has asymmetrical voltage and asymmetrical current and spike wave.

Requirements for a system inverter design which is intended to have a better display performance, a better power efficiency and a more reliable lamp.

It shall help increase the lamp lifetime and reduce its leakage current.

　　a. The asymmetry rate of the inverter current and voltage waveform should be 10% below;

　　b. The distortion rate of the current and voltage waveform should be within $\sqrt{2}\pm10\%$;

　　c. The ideal sine current and voltage waveform shall be symmetric in positive and negative polarities.

3-2 Interface Connections

- LCD connector (CN1): DF14-20P-1.25H (Hirose) or equivalent

- Mating Connector   : DF14-20C-1.25S (Hirose) or equivalent

- LVDS Transmitter: SN75LVDS83(Texas Instruments) or equivalent

Pin No.	Symbol	Function	Polarity	Note
1	VDD	Power Supply +5.0V		
2	VDD	Power Supply +5.0V		
3	GND	Power Ground		
4	GND	Power Ground		
5	Rx0-	LVDS Receiver Signal (-)		
6	Rx0+	LVDS Receiver Signal (+)		
7	GND	Ground		
8	Rx1-	LVDS Receiver Signal (-)		
9	Rx1+	LVDS Receiver Signal (+)		
10	GND	Ground		
11	Rx2-	LVDS Receiver Signal (-)		
12	Rx2+	LVDS Receiver Signal (+)		
13	GND	Ground		
14	RxCLK2-	LVDS Receiver Clock Signal (-)		
15	RxCLK2+	LVDS Receiver Clock Signal (+)		
16	GND	Ground		
17	Rx3-	LVDS Receiver Signal (-)		
18	Rx3+	LVDS Receiver Signal (+)		
19	GND	Ground		
20	NC	Reserved		

Note: All GND (ground) pins should be connected together and to Vss which should also be connected to the LCD's metal frame. All Vcc (power input) pins should be connected together.

LVDS Order Selection
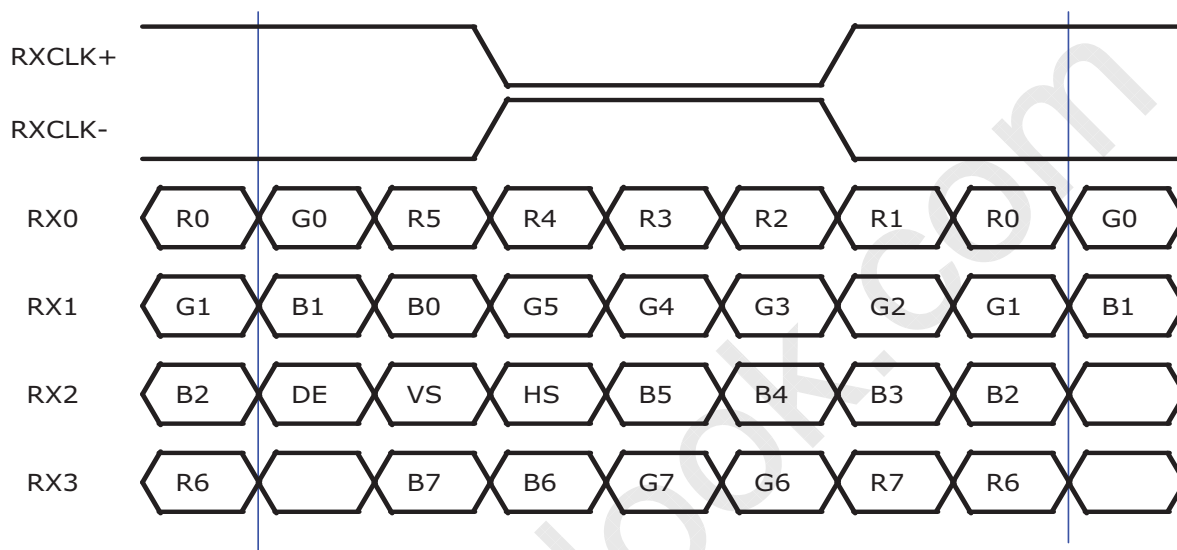
Note : Since this is DE only mode, please set the HS and VS to logic 1.

Backlight Connector Pin Configuration

Electrical specification (Lamp spec.)

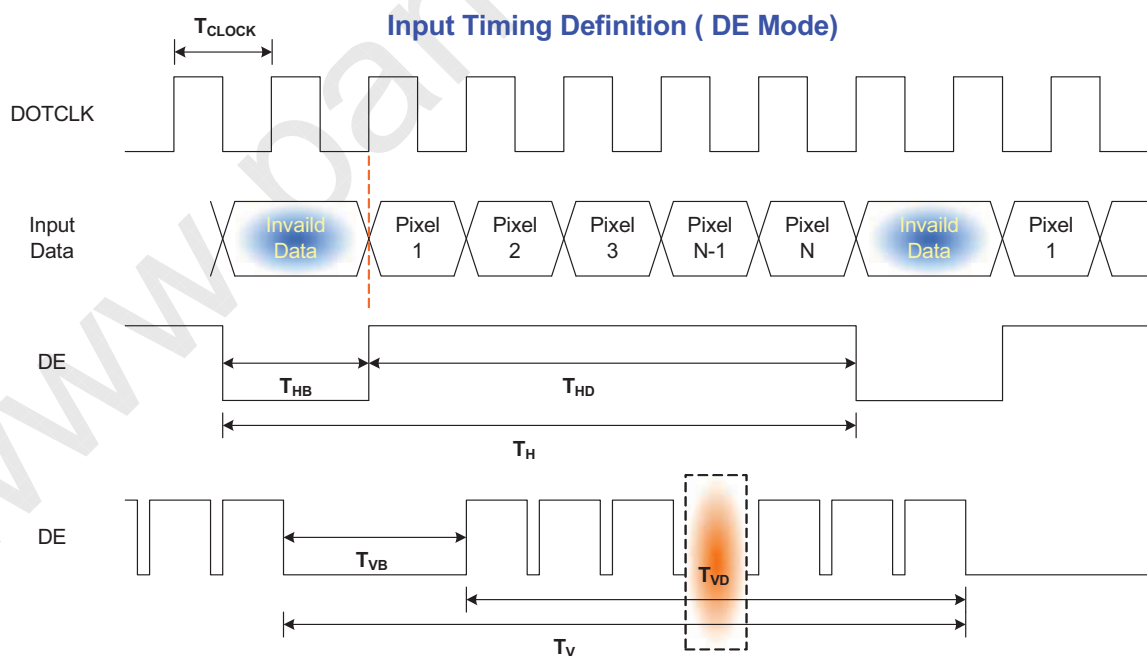| Parameter	Min	Typ	Max	Units	Condition
CCFL current(ICFL)	4.0(Ref)	4.5	7.0	[mA] rms	(Ta=25℃)
CCFL Frequency(FCFL)	50	55	60	[KHz]	(Ta=25℃)
CCFL Ignition Voltage(Vs)	1,700	-	-	[Volt] rms	(Ta= 0℃)
CCFL Voltage (Reference) (VCFL)	-	760	-	[Volt] rms	(Ta=25℃)
CCFL Power consumption (PCFL)	-	41.04	-	[Watt]	(Ta=25℃)

T201VN01 V1 Ver0.1　　　　　8/22

3-3 Signal Timing Specifications

This is the signal timing required at the input of the User connector. All of the interface signal timing should be satisfied with the following specifications for it's proper operation.

Timing Table (DE mode only)

Parameter		Symbol	Min.	Typ.	Max.	Unit
Clock frequency		$1/T_{Clock}$	20	25.18	30	MHz
Vertical Section	Period	T_V	520	525	622	T_{Line}
	Active	T_{VD}	480	480	480	
	Blanking	T_{VB}	40	45	142	
Horizontal Section	Period	T_H	770	800	1070	T_{Clock}
	Active	T_{HD}	640	640	640	
	Blanking	T_{HB}	130	160	430	

3-4 Signal Timing Waveforms

Input Timing Definition (DE Mode)

Note : Since this is DE only mode, please set the HS and VS to logic 1.

T201VN01 V1 Ver0.1　　　　9/22

3-5 Color Input Data Reference

The brightness of each primary color (red, green and blue) is based on the 8 bit gray scale data input for the color; the higher the binary input, the brighter the color. The table below provides a reference for color versus data input.

COLOR　DATA　REFERENCE

| Color		Input Color Data																							
		RED MSB LSB								GREEN MSB LSB								BLUE MSB LSB							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RED	RED(000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(001)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	RED(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	GREEN(000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0

	GREEN(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	GREEN(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
BLUE	BLUE(000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	BLUE(001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

	BLUE(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

3-6 Power Sequence
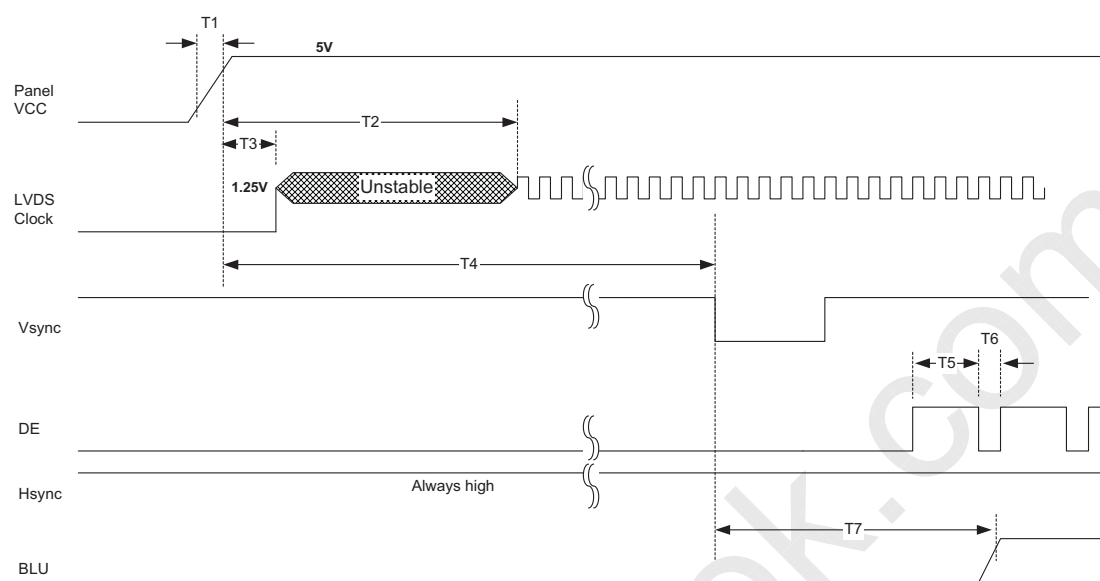
Power On Sequence

Note : Vsync is for customer system board internal signal
       Panel do not use Vsync signal, please set Vsync to High
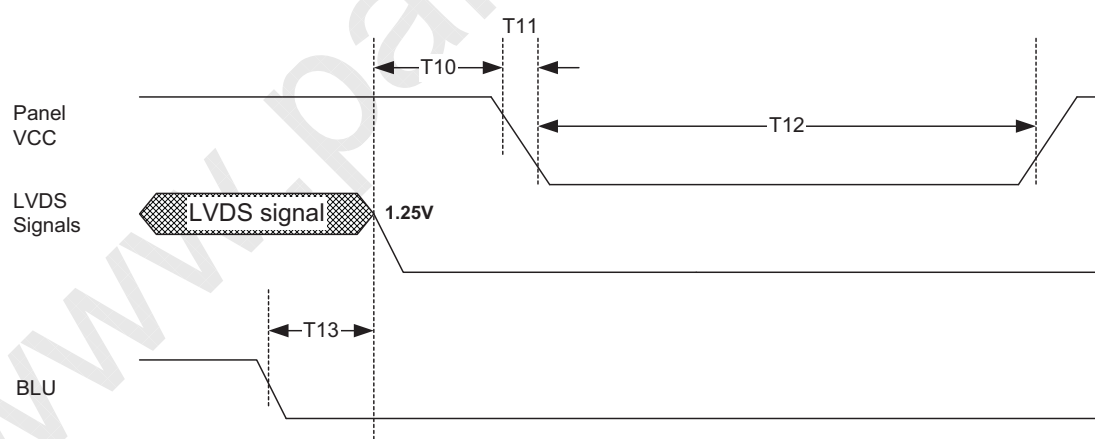
Power Off Sequence

T201VN01 V1 Ver0.1　　　　　11/22

Item	Description	Min.	Typ.	Max.	Unit	Remark
T1	PVCC rising time	200	300	400	us	10% to 90%
T2	LVDS clock unstable time from PVCC rising	0	--	12	ms	
T3	LVDS transmitter enable time	0		2	ms	
T4	First Valid Vsync edge from PVCC rising	250	300	550	ms	
T5	DE width	640	640	640	dot clks	including the first DE appeared
T6	DE blanking time	130	160	430	dot clks	
T7	BLU on delay time	48	80	--	ms	
T10	LVDS off to PVCC off	50	--	80	ms	
T11	PVCC falling time	0	--	10	ms	
T12	PVCC off time	1000	--	--	ms	
T13	BLU off time	100	--	--	ms	

Note: DE must keep low before the first valid Vsync edge

Apply the lamp voltage within the LCD operating range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal.

Caution : The above on/off sequence should be applied to avoid abnormal function in the display. In case of handling, make sure to turn off the power when you plug the cable into the input connector or pull the cable out of the connector.

4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 30 minutes in a dark environment at 25℃. The values specified are at an approximate distance 50cm from the LCD surface at a viewing angle of Φ and θ equal to 0°.
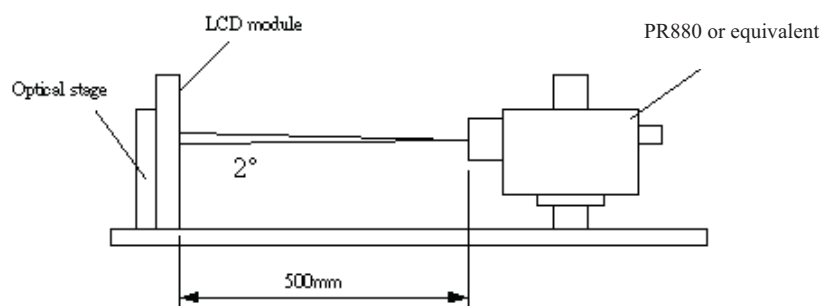

Fig.4-1 Optical measurement equipment and method

Parameter		Symbol	Values			Units	Notes
			Min.	Typ.	Max.		
Contrast Ratio		CR	450	600	-		1
Surface Luminance, white		LWH	350	500	-	cd/㎡	2
Luminance Variation		δ_{WHITE} 5 p	-	-	1.3		3
Response Time (Gray to Gray, Average)		T γ	-	-	16	ms	
Color Coordinates			-	-	-		
	RED	R_X		0.644			
		R_Y		0.333			
	GREEN	G_X		0.273			
		G_Y	TYP.	0.604	TYP.		
	BLUE	B_X	-0.03	0.145	+0.03		
		B_Y		0.064			
	WHITE	W_X		0.280			
		W_Y		0.290			
Viewing Angle (Contrast Ration>10)							
	x axis, right(φ=0°)	θ_r	-	85	-	Degree	5
	x axis, left(φ=180°)	θ_l	-	85	-		
	y axis, up(φ=90°)	θ_u	-	85	-		
	y axis, down (φ=0°)	θ_d	-	85	-		

T201VN01 V1 Ver0.1   13/24

Note:

1. Contrast Ratio (CR) is defined mathematically as:

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "white" state}}{\text{Brightness on the "black" state}}$$

2. Surface luminance is luminance value at point 1 across the LCD surface 50cm from the surface with all pixels displaying white. From more information see FIG 4-2. When I_{BL} = 4.5mA, L_{WH}=500cd/㎡ (typ.) L_{WH}=Lon1, Where Lon1 is the luminance with all pixels displaying white at center 1 location.
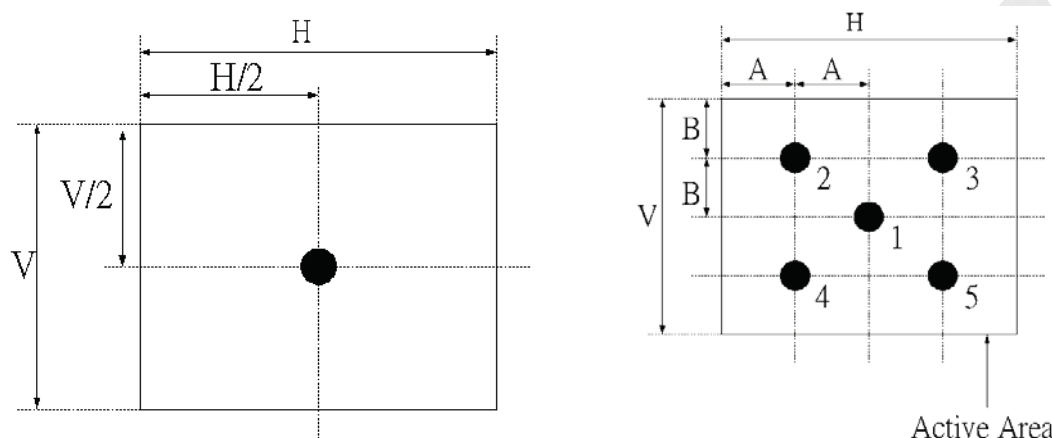
Fig.4-2 Optical measurement point

3. The variation in surface luminance, δ WHITE is defined (center of Screen) as:

$$\delta_{\text{WHITE(5P)}} = \text{Maximum}(L_{on1}, L_{on2},\ldots,L_{on5})/\text{Minimum}(L_{on1}, L_{on2},\ldots L_{on5})$$

4. Response time is the time required for the display to transition from to black (Rise Time, Tr_R=Tr) and from black to white (Decay Time, Tr_D=Tf). For additional information see FIG4-3.

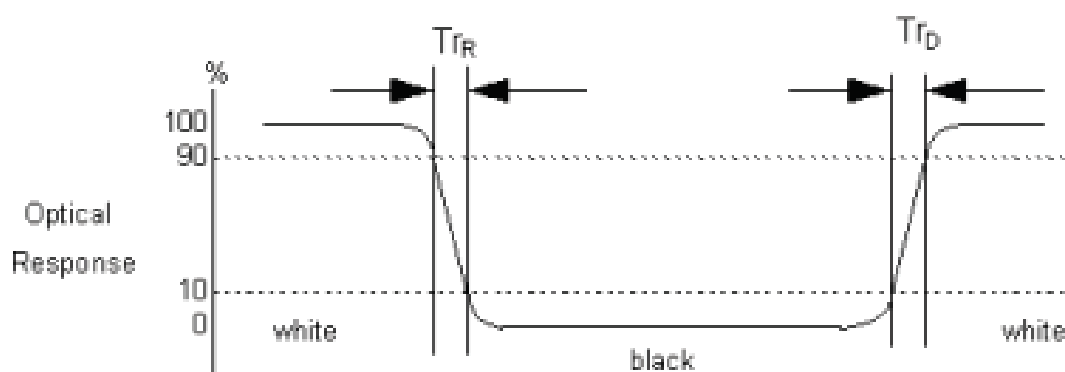**Fig.4-3 Response time**

T201VN01 V1 Ver0.1　　　　　　14/24

5. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined

for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the

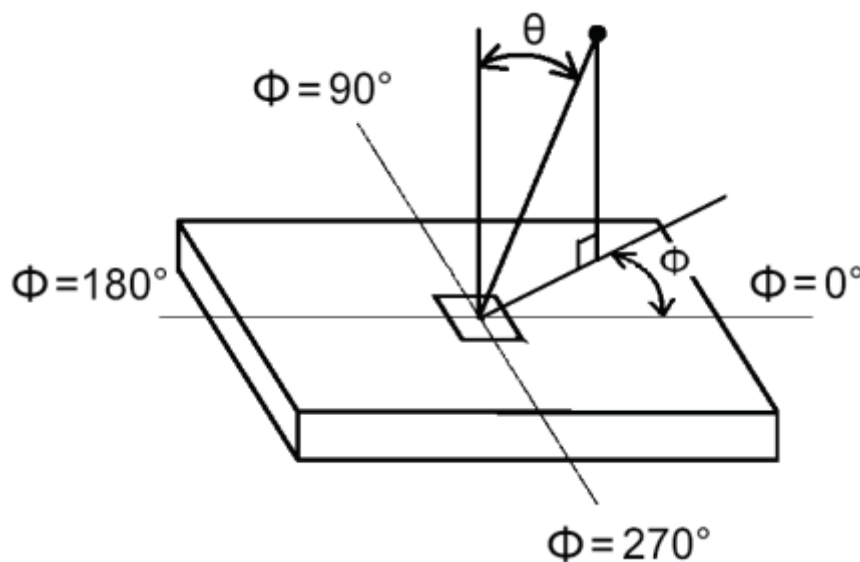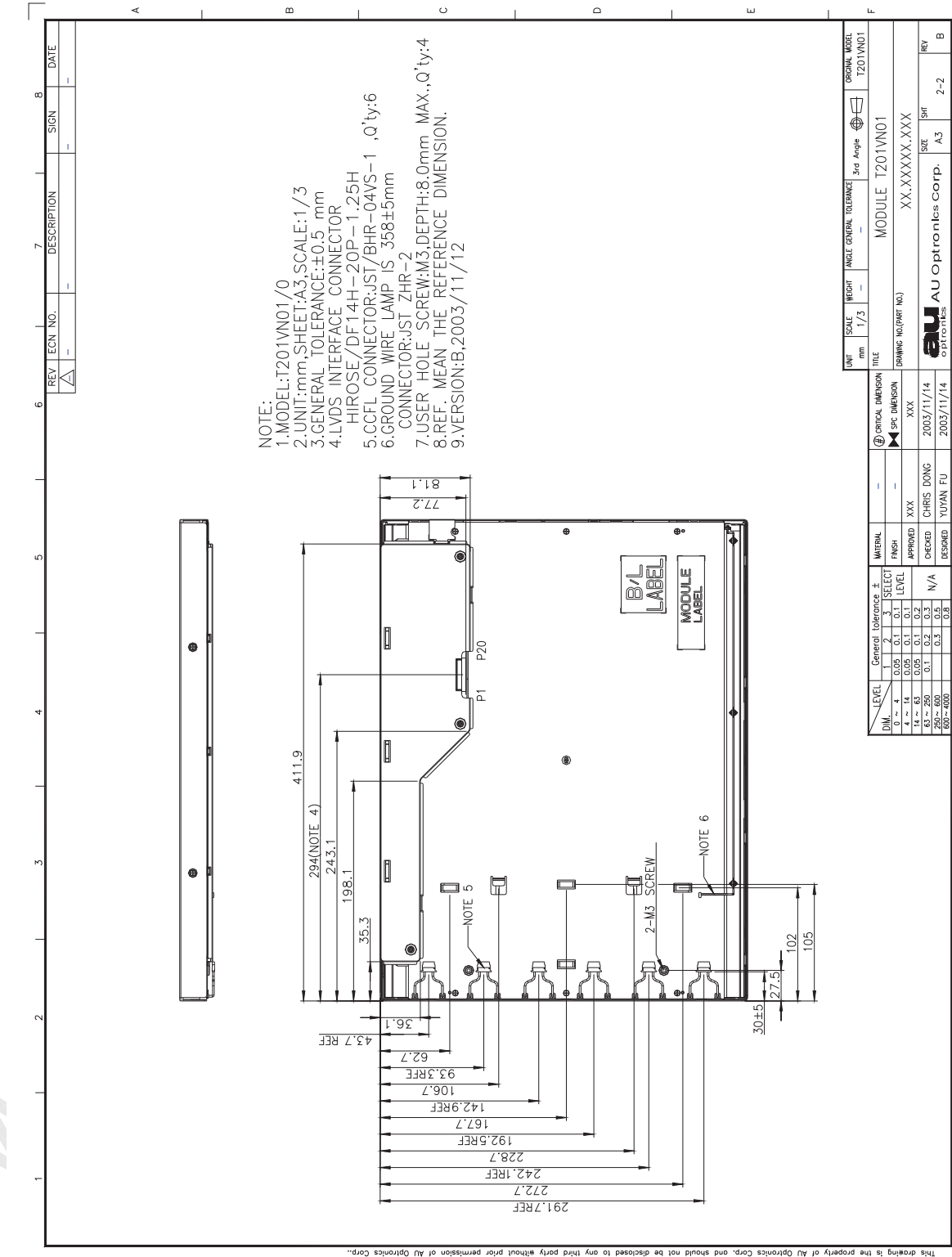LCD surface. For more information see FIG4-4.

Fig.4-4 Viewing Angle Definition

5. Mechanical Characteristics

The contents provide general mechanical characteristics for the model T201VN01. In addition the figures in the next page are detailed mechanical drawing of the LCD.

Outline Dimension	Horizontal	434.0mm
	Vertical	331.2mm
	Depth	30.6mm(w/o inverter)
Bezel Area	Horizontal	412.0mm
	Vertical	310.0mm
Active Display Area	Horizontal	408.0mm
	Vertical	306.0mm
Weight	2000g (Typ.)	
Surface Treatment	Hard Coating (3H), AG	

Front View

T201VN01 V1 Ver0.1   17/24

AUO

Rear View

NOTE:
1. MODEL:T201VN01/0
2. UNIT:mm,SHEET:A3,SCALE:1/3
3. GENERAL TOLERANCE:±0.5 mm
4. LVDS INTERFACE CONNECTOR
   HIROSE/DF14H-20P-1.25H
5. CCFL CONNECTOR:JST/BHR-04VS-1 ,Q'ty:6
6. GROUND WIRE LAMP IS 358±5mm
   CONNECTOR:JST ZHR-2
7. USER HOLE SCREW:M3,DEPTH:8.0mm MAX.,Q'ty:4
8. REF. MEAN THE REFERENCE DIMENSION.
9. VERSION:B,2003/11/12

T201VN01 V1 Ver0.1　　　　　18/24

6. Reliability

Environment test condition

No	Test Item	Condition
1	High temperature storage test	Ta=60℃　240h
2	Low temperature storage test	Ta=-20℃　240h
3	High temperature operation test	Ta=50℃　80%RH　300h
4	Low temperature operation test	Ta=0℃　240h
5	Vibration test (non-operating)	Wave form: random Vibration level : 1.0G RMS Bandwidth : 10-500Hz Duration: X, Y, Z 20min 　　　One time each direction
6	Shock test (non-operating)	Shock level: 120G Waveform: half since wave, 2ms Direction: ±X, ±Y, ±Z 　　　One time each direction
7	Vibration test (with carton)	Random Vibration:10~200Hz,1.5G,30minutes in each X,Y,Z direction
8	Drop test (with carton)	Height: 53.3cm 1 corner, 3 edges, 6 surfaces (ASTMD4169-I)
9	Altitude Storage/shipment	0-40,000 feet (12,192m)

〔Result Evaluation Criteria〕

There should be no change which might affect the practical display function when the display quality test is conducted under normal operating condition.

7. International Standard

7-1. Safety

(1)　UL1950 Third Edition, Underwriters Laboratories, Inc. Jan. 28, 1995

　　Standard for Safety of Information Technology Equipment Including electrical Business Equipment.

(2)　CAN/CSA C22.2 No. 950-95 Third Edition, Canadian Standards Association, Jan. 28, 1995

　　Standard for Safety of Information Technology Equipment Including Electrical Business Equipment.

(3)　EN60950 : 1992+A2: 1993+A2: 1993+C3: 1995+A4: 1997+A11: 1997

　　IEC 950: 1991+A1: 1992+A2: 1993+C3: 1995+A4:1996

　　European Committee for Electro technical Standardization (CENELEC)

　　EUROPEAN STANDARD for Safety of Information Technology Equipment Including Electrical Business Equipment.

7-2. EMC

a)　ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electrical Equipment in the Range of 9kHz to 40GHz. "American National standards Institute(ANSI), 1992

b)　C.I.S.P.R "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." International Special committee on Radio Interference.

c)　EN 55022 "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." European Committee for Electrotechnical Standardization. (CENELEC), 1998
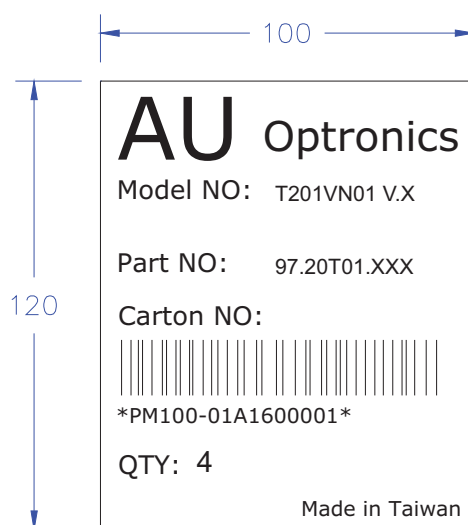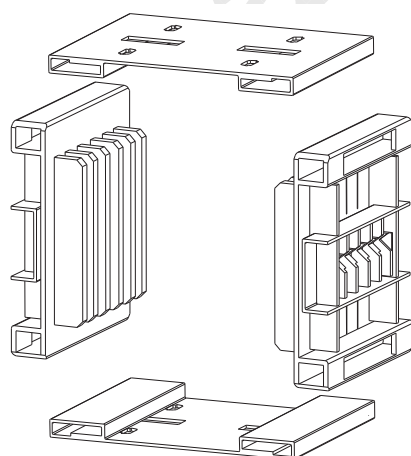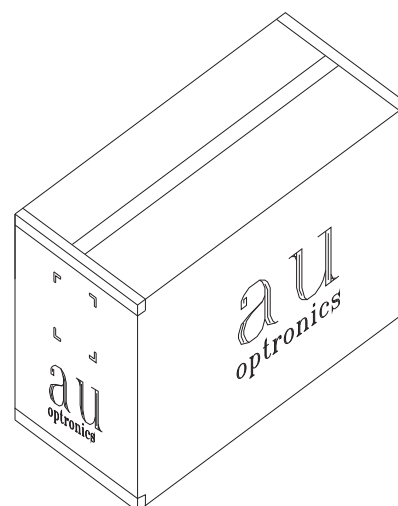
8. Packing

Label Sample

Model No: T201VN01
V.X
XX/XX
MADE IN TAIWAN
XXXX
E204356

xxxxxxxxxxxx-xxxx

xxxxxxxxxxxxxxxxxxx

Carton Label

100

120

AU Optronics

Model NO: T201VN01 V.X

Part NO: 97.20T01.XXX

Carton NO:

PM100-01A1600001

QTY: 4

Made in Taiwan
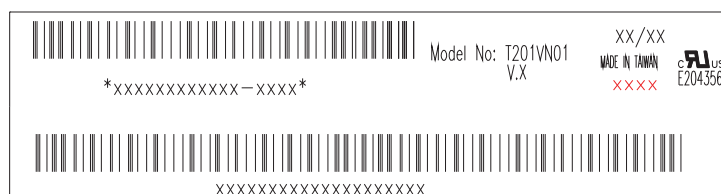
Cushion set   **Carton Box, 330mm(W)x580mm(L)x420mm(H)**

T201VN01 V1 Ver0.1   21/24

9. PRECAUTIONS

Please pay attention to the followings when you use this TFT LCD module.

9-1 MOUNTING PRECAUTIONS

(1) You must mount a module using holes arranged in four corners or four sides.

(2) You should consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.

(3) Please attach the surface transparent protective plate to the surface in order to protect the polarizer. Transparent protective plate should have sufficient strength in order to the resist external force.

(4) You should adopt radiation structure to satisfy the temperature specification.

(5) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.

(6) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment. Do not touch the surface of polarizer for bare hand or greasy cloth. (Some cosmetics are detrimental to the polarizer.)

(7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front/ rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.

(8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.

(9) Do not open the case because inside circuits do not have sufficient strength.

9-2 OPERATING PRECAUTIONS

(1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage: V=±200mV(Over and under shoot voltage)

(2) Response time depends on the temperature. (In lower temperature, it becomes longer..)

(3) Brightness depends on the temperature. (In lower temperature, it becomes lower.) And in lower temperature, response time (required time that brightness is stable after turned on) becomes longer.

(4) Be careful for condensation at sudden temperature change. Condensation makes

T201VN01 V1 Ver0.1   22/24

damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.

(5) When fixed patterns are displayed for a long time, remnant image is likely to occur.

(6) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interface.

9-3 ELECTROSTATIC DISCHARGE CONTROL

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

9-4 PRECAUTIONS FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

9-5 STORAGE

When storing modules as spares for a long time, the following precautions are necessary.

(1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5℃ and 35℃ at normal humidity.

(2) The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.

9-6 HANDLING PRECAUTIONS FOR PROTECTION FILM

(1) The protection film is attached to the bezel with a small masking tape. When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.

(2) When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of flue still on the Bezel after the protection film is peeled off.

(3) You can remove the glue easily. When the glue remains on the Bezel or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.